FIG.1

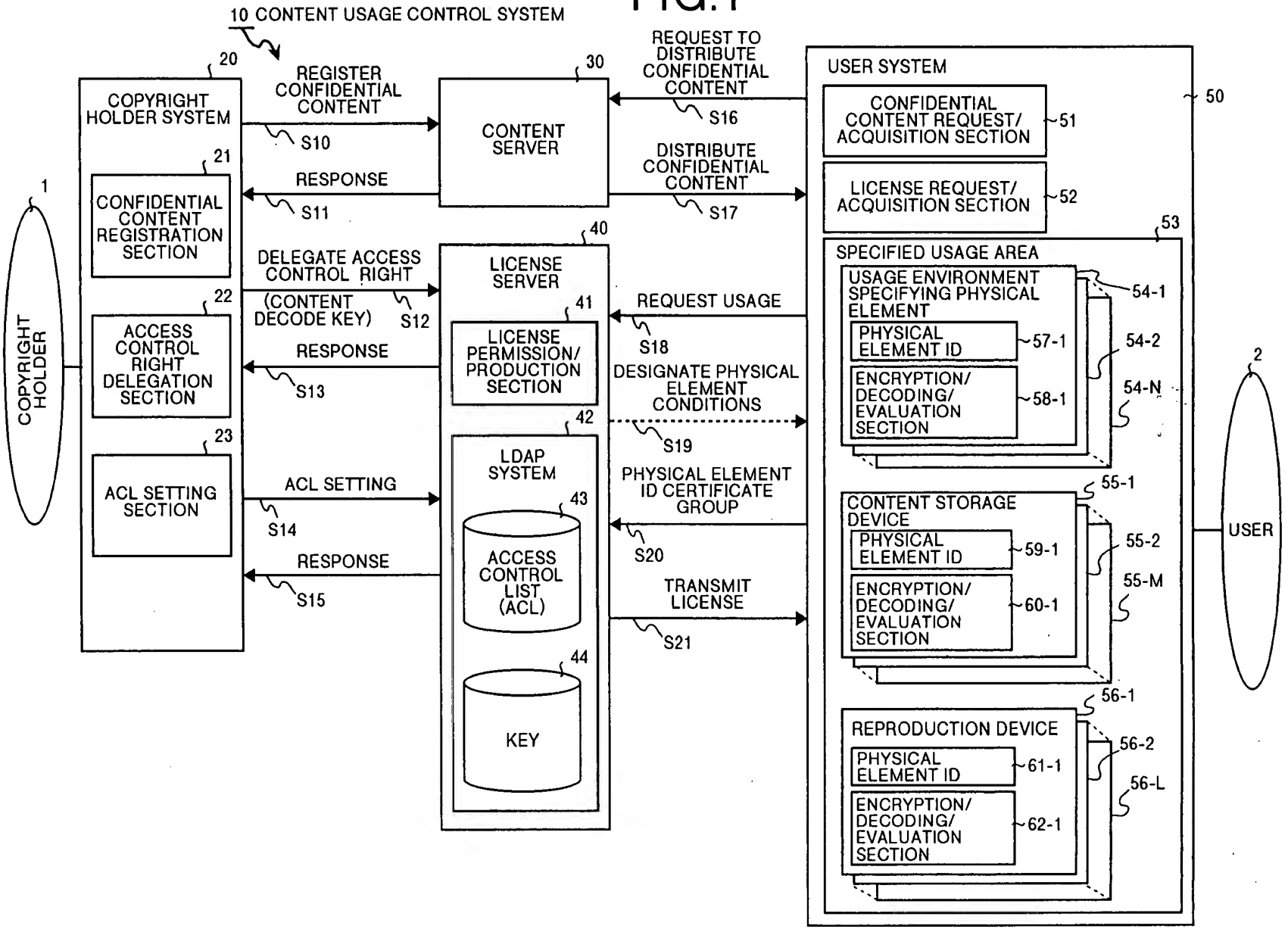

10 CONTENT USAGE CONTROL SYSTEM
1
COPYRIGHT HOLDER
20
COPYRIGHT HOLDER SYSTEM
21
CONFIDENTIAL CONTENT REGISTRATION SECTION
22
ACCESS CONTROL RIGHT DELEGATION SECTION
23
ACL SETTING SECTION
REGISTER CONFIDENTIAL CONTENT
S10
RESPONSE
S11
DELEGATE ACCESS CONTROL RIGHT (CONTENT DECODE KEY)
S12
RESPONSE
S13
ACL SETTING
S14
RESPONSE
S15
30
CONTENT SERVER
40
LICENSE SERVER
41
LICENSE PERMISSION/ PRODUCTION SECTION
42
LDAP SYSTEM
43
ACCESS CONTROL LIST (ACL)
44
KEY
REQUEST TO DISTRIBUTE CONFIDENTIAL CONTENT
S16
DISTRIBUTE CONFIDENTIAL CONTENT
S17
REQUEST USAGE
S18
DESIGNATE PHYSICAL ELEMENT CONDITIONS
S19
PHYSICAL ELEMENT ID CERTIFICATE GROUP
S20
TRANSMIT LICENSE
S21
USER SYSTEM
50
CONFIDENTIAL CONTENT REQUEST/ ACQUISITION SECTION
51
LICENSE REQUEST/ ACQUISITION SECTION
52
53
SPECIFIED USAGE AREA
USAGE ENVIRONMENT SPECIFYING PHYSICAL ELEMENT
54-1
PHYSICAL ELEMENT ID
57-1
ENCRYPTION/ DECODING/ EVALUATION SECTION
58-1
54-2
54-N
CONTENT STORAGE DEVICE
55-1
PHYSICAL ELEMENT ID
59-1
ENCRYPTION/ DECODING/ EVALUATION SECTION
60-1
55-2
55-M
REPRODUCTION DEVICE
56-1
PHYSICAL ELEMENT ID
61-1
ENCRYPTION/ DECODING/ EVALUATION SECTION
62-1
56-2
56-L
2
USER

FIG.2

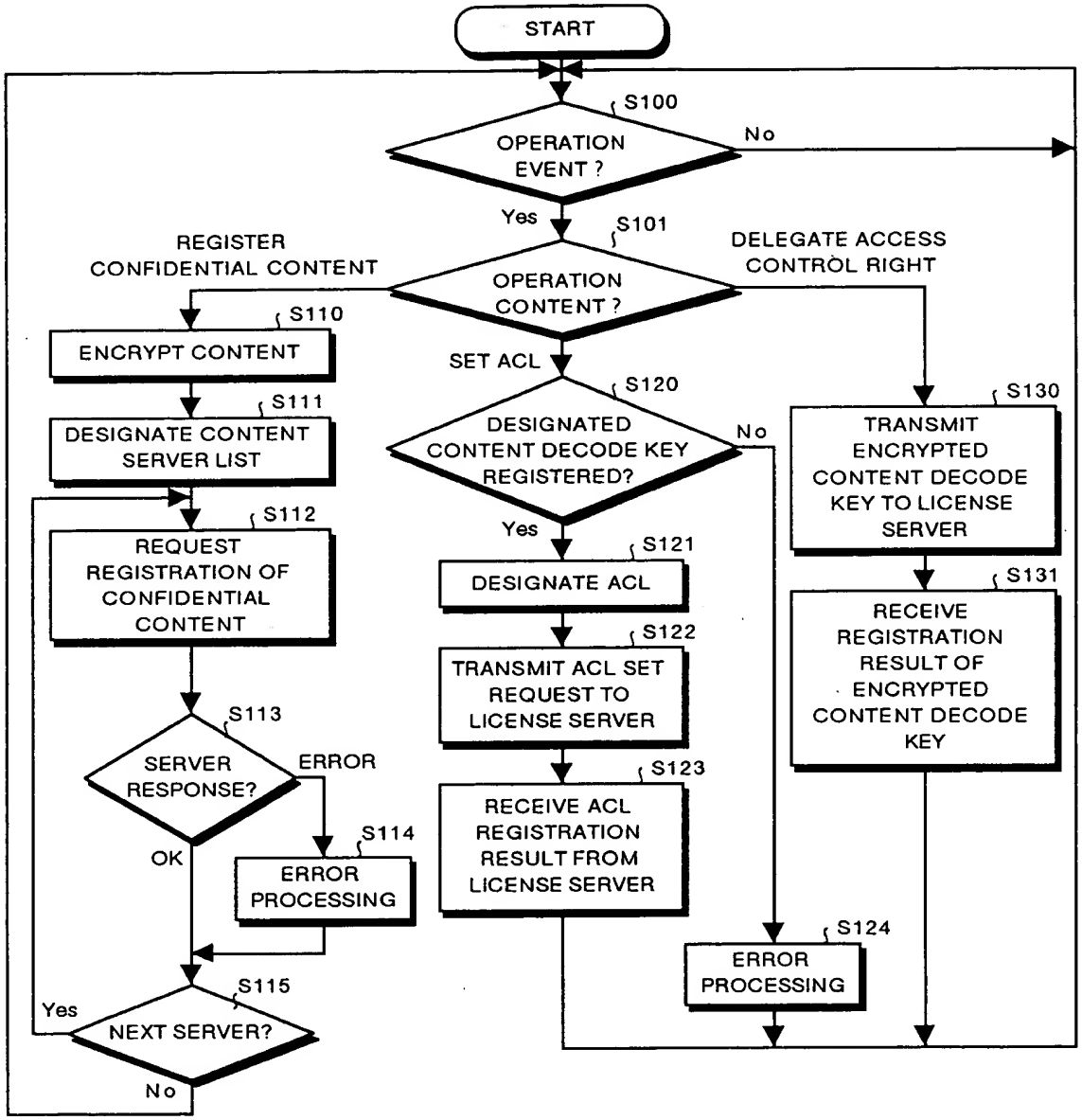

START
S100
OPERATION EVENT ?
No
Yes
S101
OPERATION CONTENT ?
REGISTER CONFIDENTIAL CONTENT
SET ACL
DELEGATE ACCESS CONTROL RIGHT
S110
ENCRYPT CONTENT
S111
DESIGNATE CONTENT SERVER LIST
S112
REQUEST REGISTRATION OF CONFIDENTIAL CONTENT
S113
SERVER RESPONSE?
ERROR
OK
S114
ERROR PROCESSING
S115
Yes
NEXT SERVER?
No
S120
DESIGNATED CONTENT DECODE KEY REGISTERED?
No
Yes
S121
DESIGNATE ACL
S122
TRANSMIT ACL SET REQUEST TO LICENSE SERVER
S123
RECEIVE ACL REGISTRATION RESULT FROM LICENSE SERVER
S124
ERROR PROCESSING
S130
TRANSMIT ENCRYPTED CONTENT DECODE KEY TO LICENSE SERVER
S131
RECEIVE REGISTRATION RESULT OF ENCRYPTED CONTENT DECODE KEY

FIG.3

ACCOUNT CONDITION VALUE	USAGE STATE
Max Count : MAXIMUM NUMBER OF OPERABLE SESSIONS	count : COUNT OF NUMBER OF OPERATIONS COMPLETE
Max Length : MAXIMUM READ LENGTH	totalLen : READ LENGTH PLUS REQUESTED READ LENGTH
max TimeLen : MAXIMUM EXECUTABLE TIME	totalTime : EXECUTED TIME LENGTH
max Debt : CREDIT LINE (CHARGING CONDITION)	debt : OUTSTANDING AMOUNT(DEBT WHEN NEGATIVE)

PHYSICAL ENVIRONMENT SPECIFYING ELEMENT (PCSUE) CONDITION	PHYSICAL ELEMENT ID CLASS (PCSUE-IDClass)
(1) COMPUTER BODY	PSN (PROCESSOR SERIAL NUMBER)
(2) PERIPHERAL DEVICES	DSN : DEVICE TYPE, SERIAL NUMBER
(3) MEDIA	MSN : MEDIA TYPE, SERIAL NUMBER
(4) IC CARD	certificates : CERTIFICATES ISSUED BY IC CARD
(5) HUMAN BODY PARTS (FINGERPRINTS, IRIS, etc.)	body Parts : BODY PARTS (FINGERPRINTS, IRIS, etc.) AUTHENTICATION INFORMATION
(6) PERMITTED TIME ZONE	time Period : TIME POINT (LOCAL CLOCK, GPS, etc.)
(7) NETWORK DOMAIN	MACAddress : MAC ADDRESS
(8) GEOGRAPHICAL POSITION (COUNTRY OF USAGE, etc.)	location : GPS/PHS DETECTION POSITION
(9) HUMAN MEMORY	user-ID WithPwd : USER ID AND PASSWORD
(10) GROUP	group : SET OF PHYSICAL ELEMENT IDS

FIG.4

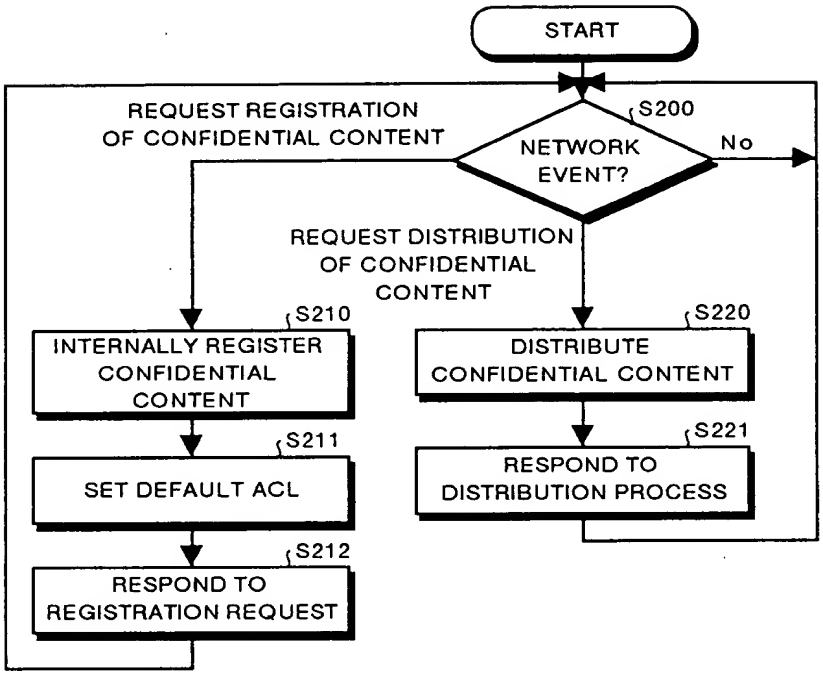

START
REQUEST REGISTRATION OF CONFIDENTIAL CONTENT
S200
NETWORK EVENT?
No
REQUEST DISTRIBUTION OF CONFIDENTIAL CONTENT
S210
INTERNALLY REGISTER CONFIDENTIAL CONTENT
S211
SET DEFAULT ACL
S212
RESPOND TO REGISTRATION REQUEST
S220
DISTRIBUTE CONFIDENTIAL CONTENT
S221
RESPOND TO DISTRIBUTION PROCESS

FIG.5

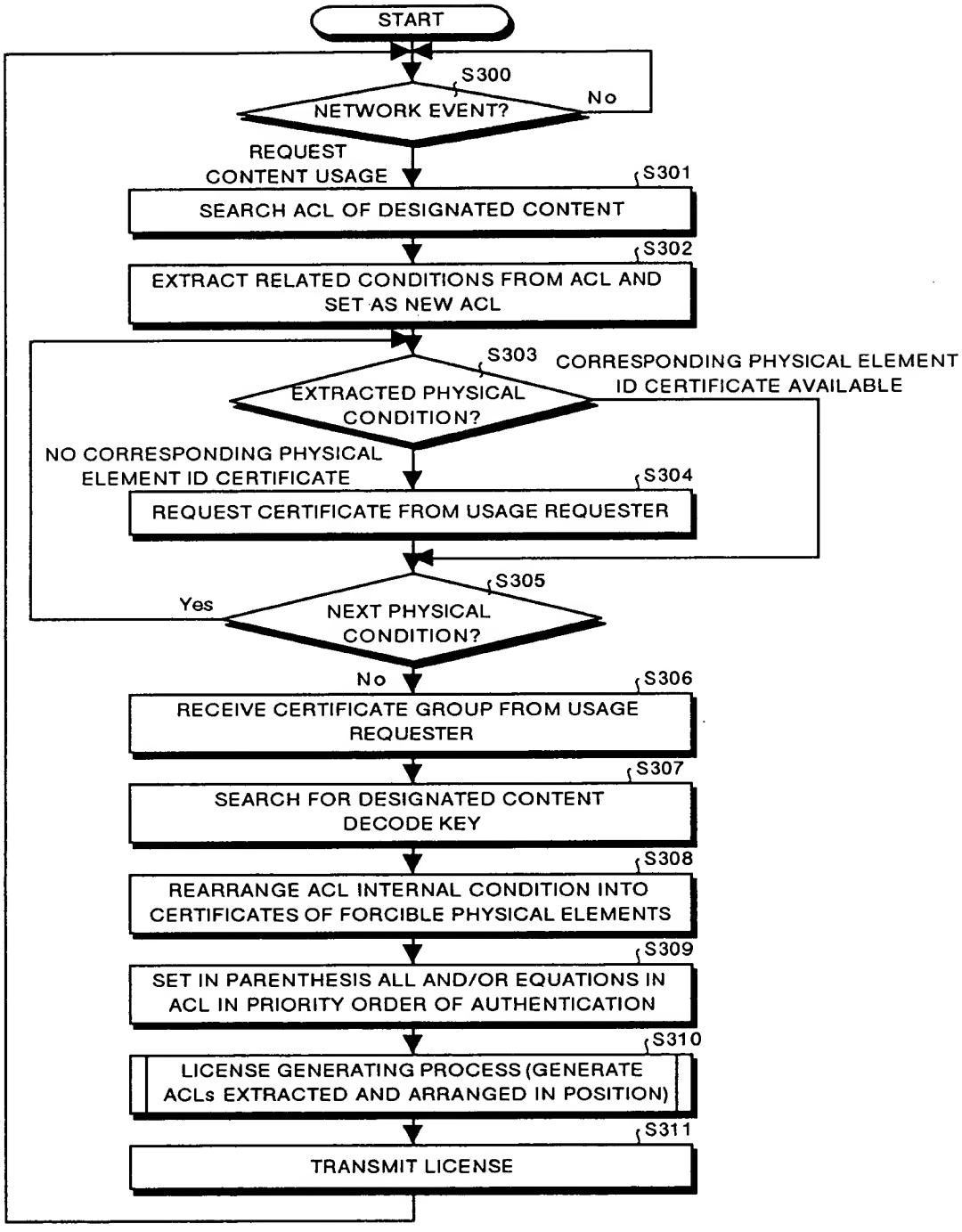

START
S300
NETWORK EVENT?
No
REQUEST CONTENT USAGE
S301
SEARCH ACL OF DESIGNATED CONTENT
S302
EXTRACT RELATED CONDITIONS FROM ACL AND SET AS NEW ACL
S303
EXTRACTED PHYSICAL CONDITION?
CORRESPONDING PHYSICAL ELEMENT ID CERTIFICATE AVAILABLE
NO CORRESPONDING PHYSICAL ELEMENT ID CERTIFICATE
S304
REQUEST CERTIFICATE FROM USAGE REQUESTER
S305
Yes
NEXT PHYSICAL CONDITION?
No
S306
RECEIVE CERTIFICATE GROUP FROM USAGE REQUESTER
S307
SEARCH FOR DESIGNATED CONTENT DECODE KEY
S308
REARRANGE ACL INTERNAL CONDITION INTO CERTIFICATES OF FORCIBLE PHYSICAL ELEMENTS
S309
SET IN PARENTHESIS ALL AND/OR EQUATIONS IN ACL IN PRIORITY ORDER OF AUTHENTICATION
S310
LICENSE GENERATING PROCESS (GENERATE ACLs EXTRACTED AND ARRANGED IN POSITION)
S311
TRANSMIT LICENSE

FIG.6

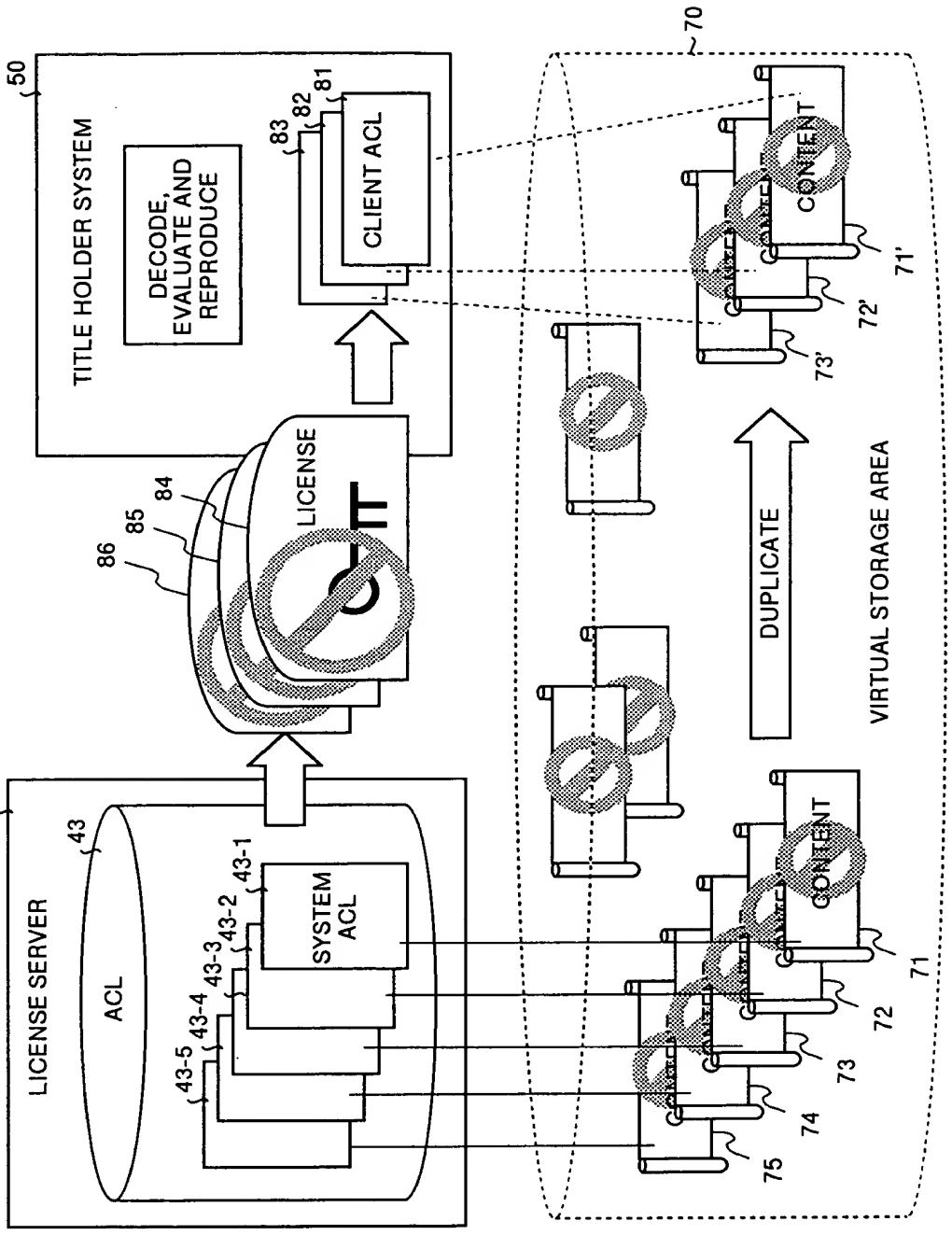

50
TITLE HOLDER SYSTEM
DECODE, EVALUATE AND REPRODUCE
81
82
83
CLIENT ACL
84
85
86
LICENSE
CT
40
LICENSE SERVER
43
ACL
43-1
43-2
43-3
43-4
43-5
SYSTEM ACL
70
CONTENT
71
71'
72
72'
73
73'
74
75
DUPLICATE
VIRTUAL STORAGE AREA

FIG.7

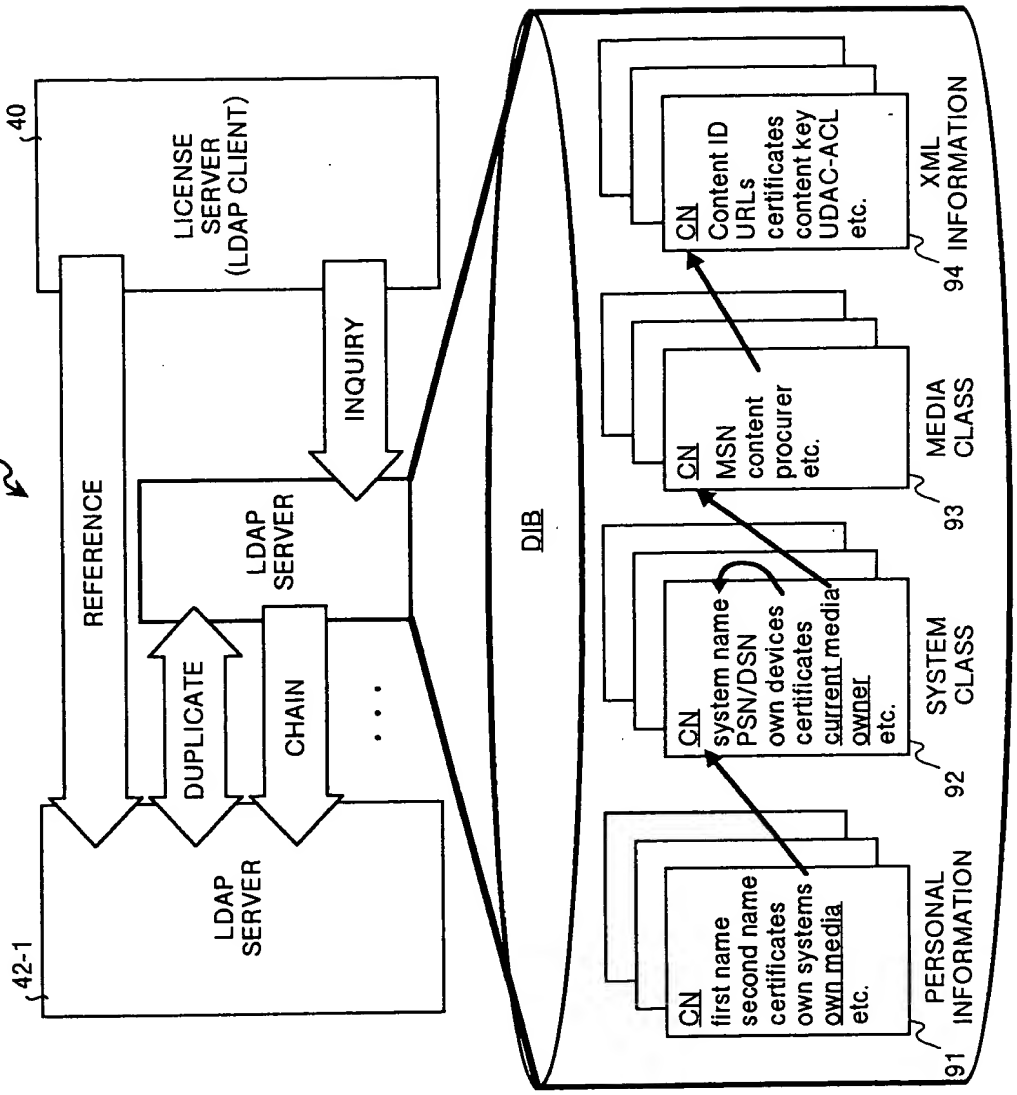

42 LDAP SYSTEM
40
LICENSE SERVER (LDAP CLIENT)
REFERENCE
INQUIRY
LDAP SERVER
DUPLICATE
CHAIN
LDAP SERVER
42-1
DIB
CN first name second name certificates own systems own media etc.
PERSONAL INFORMATION
91
CN system name PSN/DSN own devices certificates current media owner etc.
SYSTEM CLASS
92
CN MSN content procurer etc.
MEDIA CLASS
93
CN Content ID URLs certificates content key UDAC-ACL etc.
XML INFORMATION
94

FIG.8

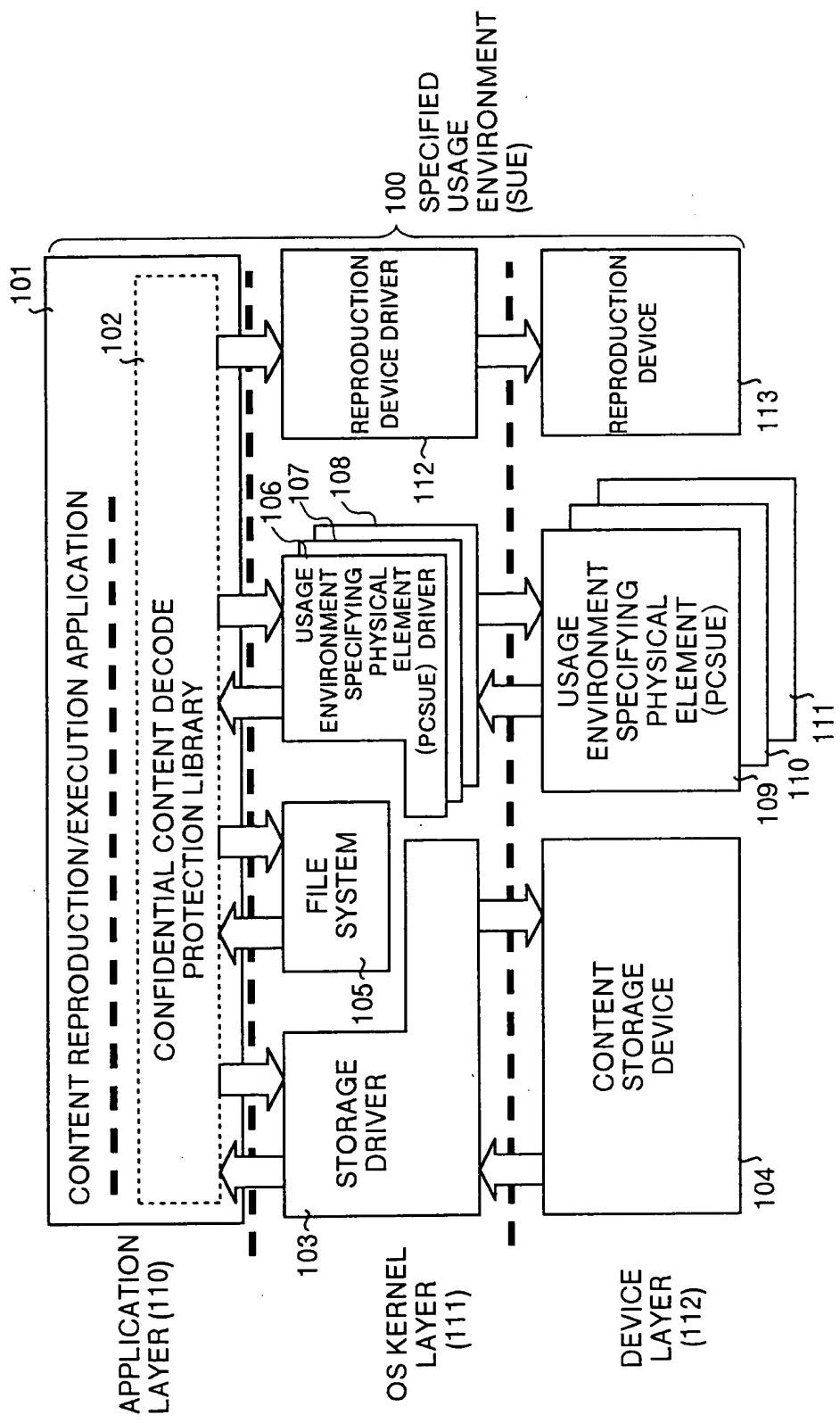

100
SPECIFIED USAGE ENVIRONMENT (SUE)
101
CONTENT REPRODUCTION/EXECUTION APPLICATION
102
CONFIDENTIAL CONTENT DECODE PROTECTION LIBRARY
REPRODUCTION DEVICE DRIVER
112
REPRODUCTION DEVICE
113
106
107
108
USAGE ENVIRONMENT SPECIFYING PHYSICAL ELEMENT (PCSUE) DRIVER
USAGE ENVIRONMENT SPECIFYING PHYSICAL ELEMENT (PCSUE)
109
110
111
FILE SYSTEM
105
STORAGE DRIVER
103
CONTENT STORAGE DEVICE
104
APPLICATION LAYER (110)
OS KERNEL LAYER (111)
DEVICE LAYER (112)

FIG.9

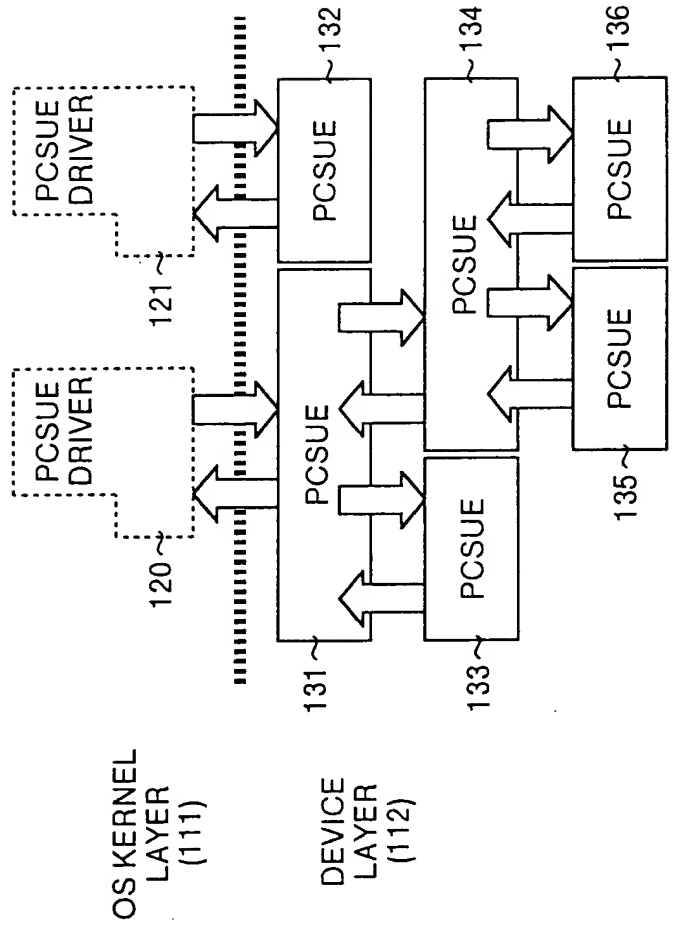

OS KERNEL LAYER (111)
DEVICE LAYER (112)
PCSUE DRIVER
PCSUE DRIVER
120
121
131
132
133
134
135
136
PCSUE
PCSUE
PCSUE
PCSUE
PCSUE
PCSUE

FIG.10

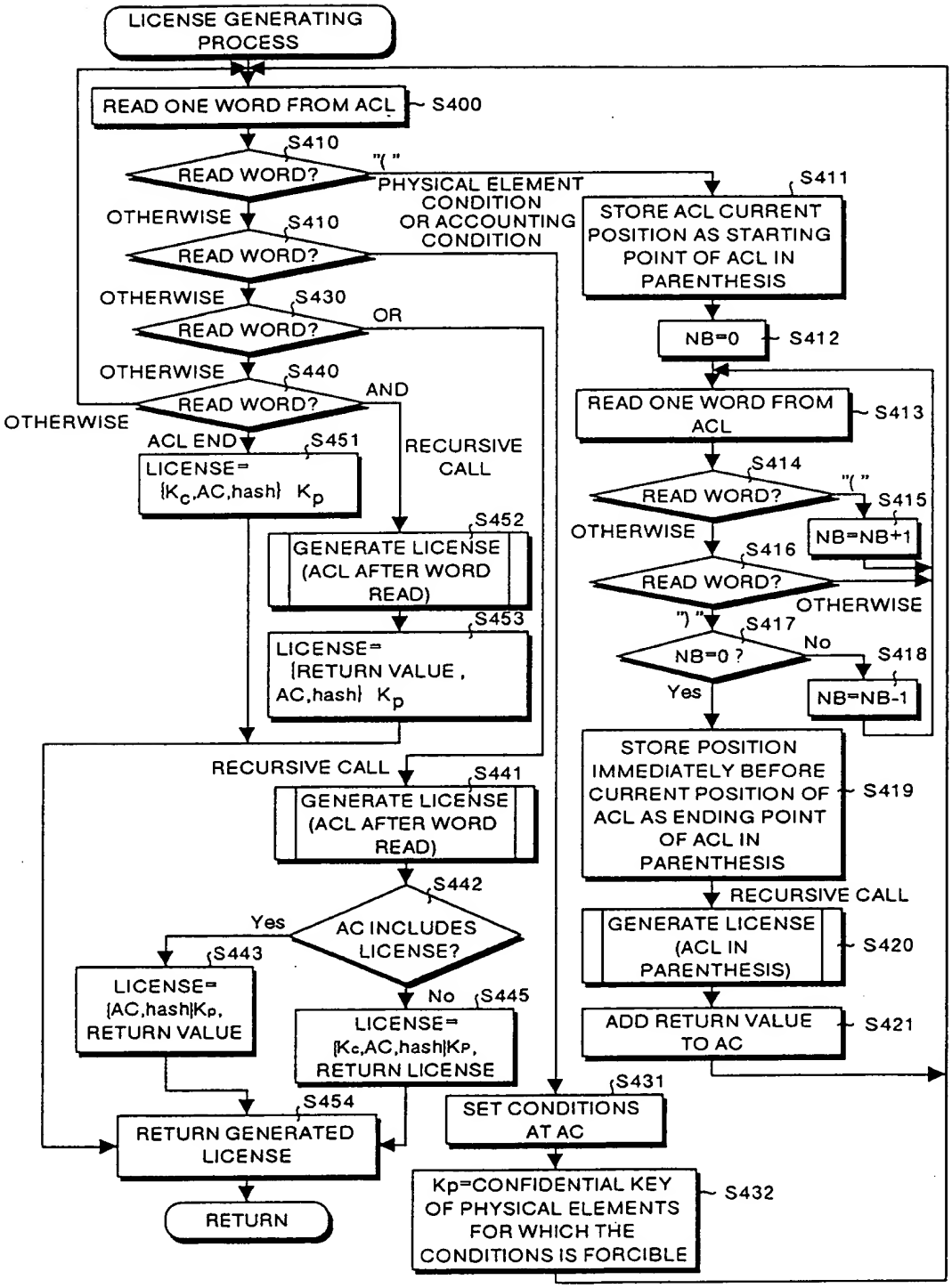

LICENSE GENERATING PROCESS
READ ONE WORD FROM ACL
S400
S410
READ WORD?
"("
PHYSICAL ELEMENT CONDITION OR ACCOUNTING CONDITION
S411
STORE ACL CURRENT POSITION AS STARTING POINT OF ACL IN PARENTHESIS
OTHERWISE
S410
READ WORD?
OTHERWISE
S430
READ WORD?
OR
NB=0
S412
OTHERWISE
S440
READ WORD?
AND
READ ONE WORD FROM ACL
S413
OTHERWISE
ACL END
S451
LICENSE= {Kc,AC,hash} Kp
RECURSIVE CALL
S414
READ WORD?
"("
S415
NB=NB+1
OTHERWISE
S452
GENERATE LICENSE (ACL AFTER WORD READ)
S416
READ WORD?
OTHERWISE
") "
S417
NB=0 ?
No
S418
NB=NB-1
Yes
S453
LICENSE= {RETURN VALUE , AC,hash} Kp
STORE POSITION IMMEDIATELY BEFORE CURRENT POSITION OF ACL AS ENDING POINT OF ACL IN PARENTHESIS
S419
RECURSIVE CALL
RECURSIVE CALL
S441
GENERATE LICENSE (ACL AFTER WORD READ)
RECURSIVE CALL
GENERATE LICENSE (ACL IN PARENTHESIS)
S420
S442
Yes
AC INCLUDES LICENSE?
S443
LICENSE= {AC,hash}Kp, RETURN VALUE
No
S445
LICENSE= {Kc,AC,hash}Kp, RETURN LICENSE
ADD RETURN VALUE TO AC
S421
S431
SET CONDITIONS AT AC
S454
RETURN GENERATED LICENSE
Kp=CONFIDENTIAL KEY OF PHYSICAL ELEMENTS FOR WHICH THE CONDITIONS IS FORCIBLE
S432
RETURN

FIG.11

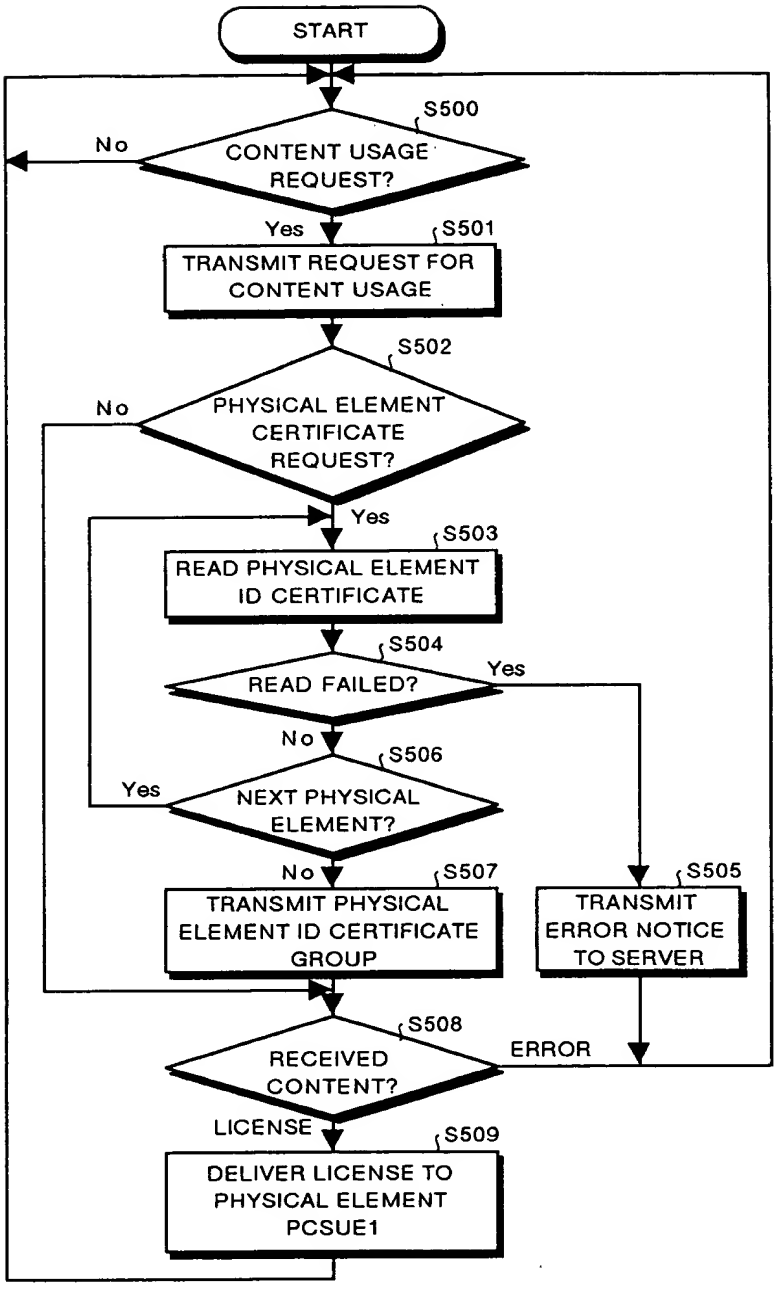

START
S500
CONTENT USAGE REQUEST?
No
Yes
S501
TRANSMIT REQUEST FOR CONTENT USAGE
S502
PHYSICAL ELEMENT CERTIFICATE REQUEST?
No
Yes
S503
READ PHYSICAL ELEMENT ID CERTIFICATE
S504
READ FAILED?
Yes
No
S506
NEXT PHYSICAL ELEMENT?
Yes
No
S507
TRANSMIT PHYSICAL ELEMENT ID CERTIFICATE GROUP
S505
TRANSMIT ERROR NOTICE TO SERVER
S508
RECEIVED CONTENT?
ERROR
LICENSE
S509
DELIVER LICENSE TO PHYSICAL ELEMENT PCSUE1

FIG.12

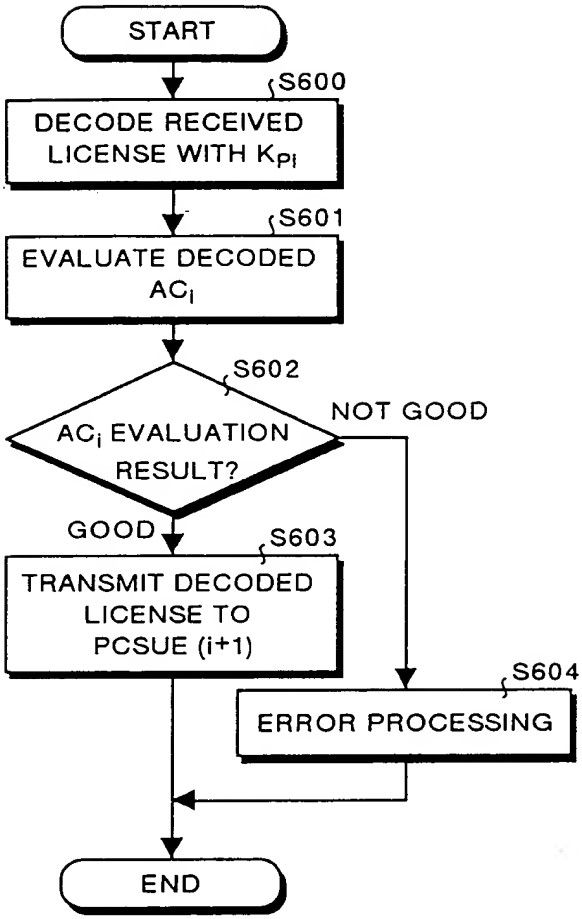

START
S600
DECODE RECEIVED LICENSE WITH K_{PI}
S601
EVALUATE DECODED AC_I
S602
AC_i EVALUATION RESULT?
NOT GOOD
GOOD
S603
TRANSMIT DECODED LICENSE TO PCSUE (i+1)
S604
ERROR PROCESSING
END

FIG.13

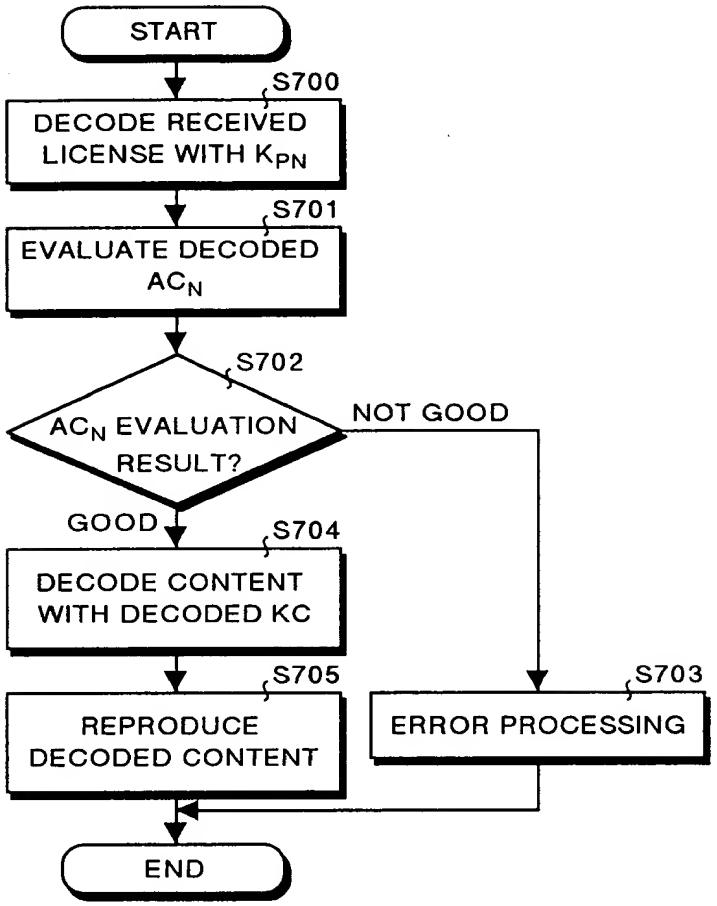

START
S700
DECODE RECEIVED LICENSE WITH K_{PN}
S701
EVALUATE DECODED AC_N
S702
AC_N EVALUATION RESULT?
NOT GOOD
GOOD
S704
DECODE CONTENT WITH DECODED KC
S705
REPRODUCE DECODED CONTENT
S703
ERROR PROCESSING
END

FIG.14

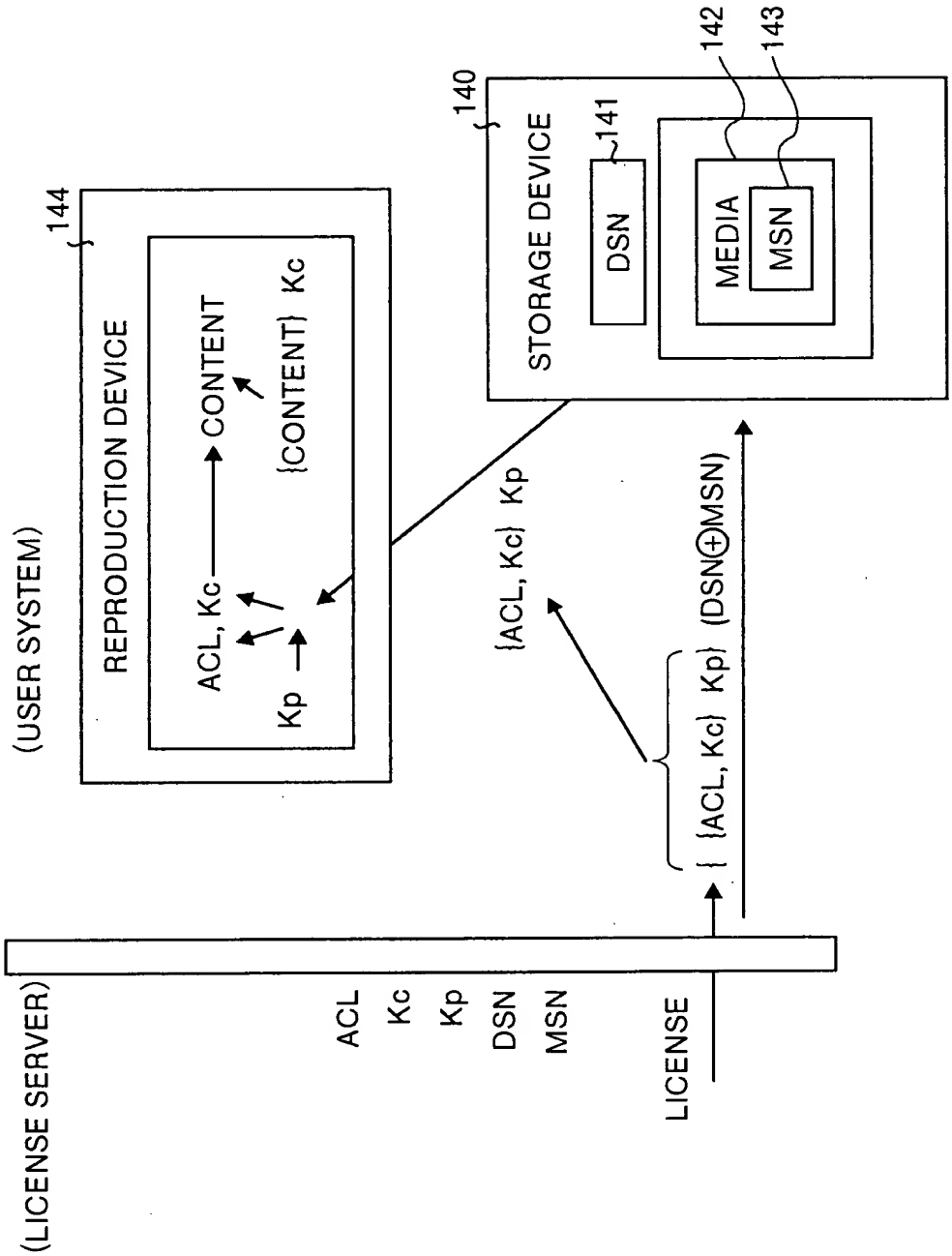

(LICENSE SERVER)
(USER SYSTEM)
144
REPRODUCTION DEVICE
ACL, Kc
Kp
CONTENT
{CONTENT} Kc
140
STORAGE DEVICE
141
DSN
142
MEDIA
143
MSN
{ACL, Kc} Kp
{ {ACL, Kc} Kp} (DSN⊕MSN)
ACL
Kc
Kp
DSN
MSN
LICENSE

FIG.15

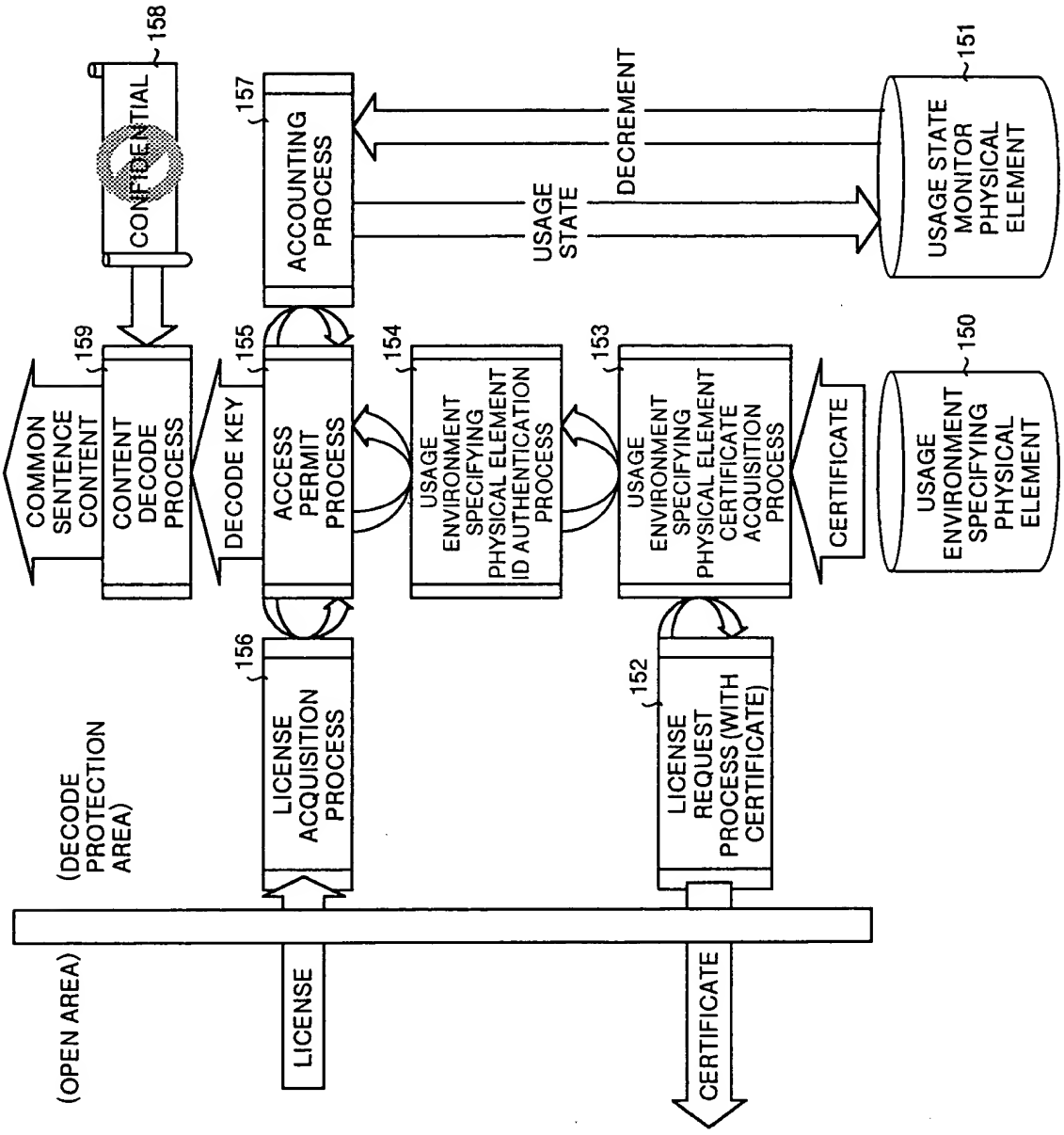

(OPEN AREA)
(DECODE PROTECTION AREA)
LICENSE
CERTIFICATE
CONFIDENTIAL
158
COMMON SENTENCE CONTENT
159
CONTENT DECODE PROCESS
DECODE KEY
155
ACCESS PERMIT PROCESS
157
ACCOUNTING PROCESS
DECREMENT
USAGE STATE
151
USAGE STATE MONITOR PHYSICAL ELEMENT
154
USAGE ENVIRONMENT SPECIFYING PHYSICAL ELEMENT ID AUTHENTICATION PROCESS
153
USAGE ENVIRONMENT SPECIFYING PHYSICAL ELEMENT CERTIFICATE ACQUISITION PROCESS
CERTIFICATE
150
USAGE ENVIRONMENT SPECIFYING PHYSICAL ELEMENT
156
LICENSE ACQUISITION PROCESS
152
LICENSE REQUEST PROCESS (WITH CERTIFICATE)

FIG.16

	APPLICATION LAYER	DEVICE DRIVER LAYER	DEVICE LAYER
GENERATION OF USAGE ENVIRONMENT SPECIFYING PHYSICAL ELEMENT OWNERSHIP CERTIFICATE	—	○	◎
AUTHENTICATION OF USAGE ENVIRONMENT SPECIFYING PHYSICAL ELEMENT ID	○	—	—
SEARCH OF ACCESS CONTROL LIST	○	—	○
PROTECTION OF ACCORDING INFORMATION	△	—	◎ (IC CARD)
CONDITIONAL ACCESS PERMISSION	○	—	○
DECODE	○	—	○

— : INCORPORATION NOT SO MEANINGFUL
△ : DANGEROUS
○ : PROTECTION NOT TIGHT FOR PROFESSIONAL
◎ : PROTECTION TIGHT

FIG.17

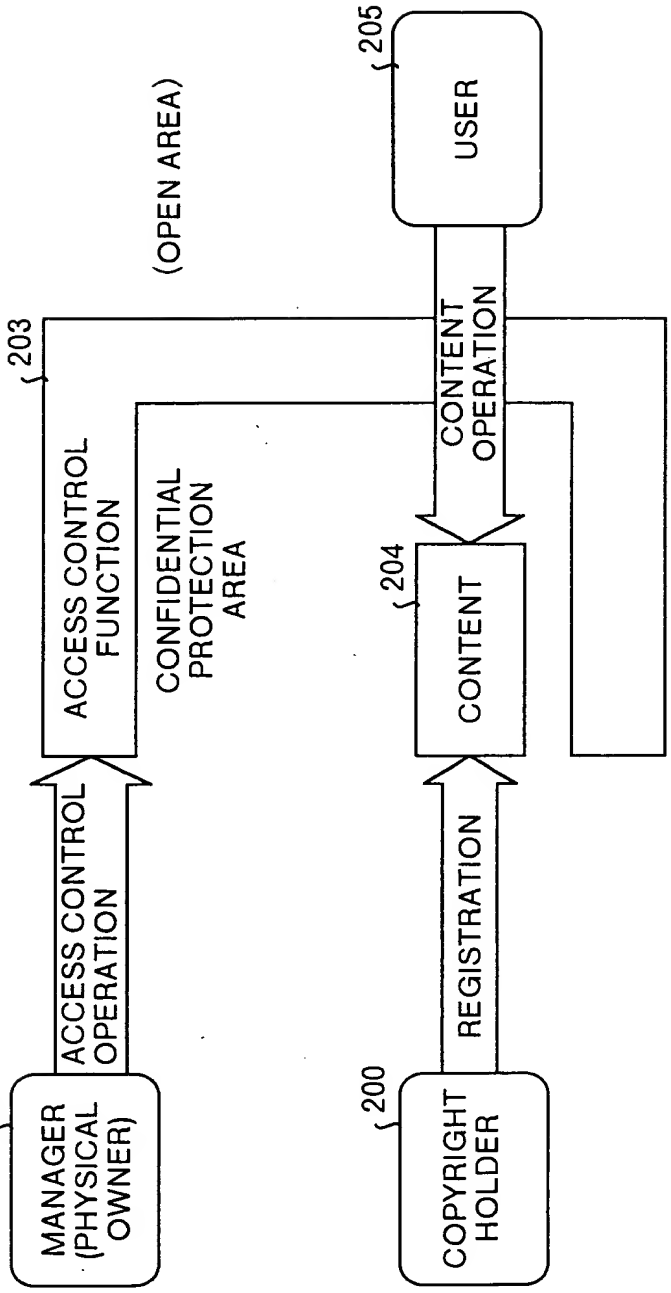

201
MANAGER (PHYSICAL OWNER)
ACCESS CONTROL OPERATION
203
ACCESS CONTROL FUNCTION
CONFIDENTIAL PROTECTION AREA
(OPEN AREA)
200
COPYRIGHT HOLDER
REGISTRATION
204
CONTENT
CONTENT OPERATION
205
USER

FIG.18

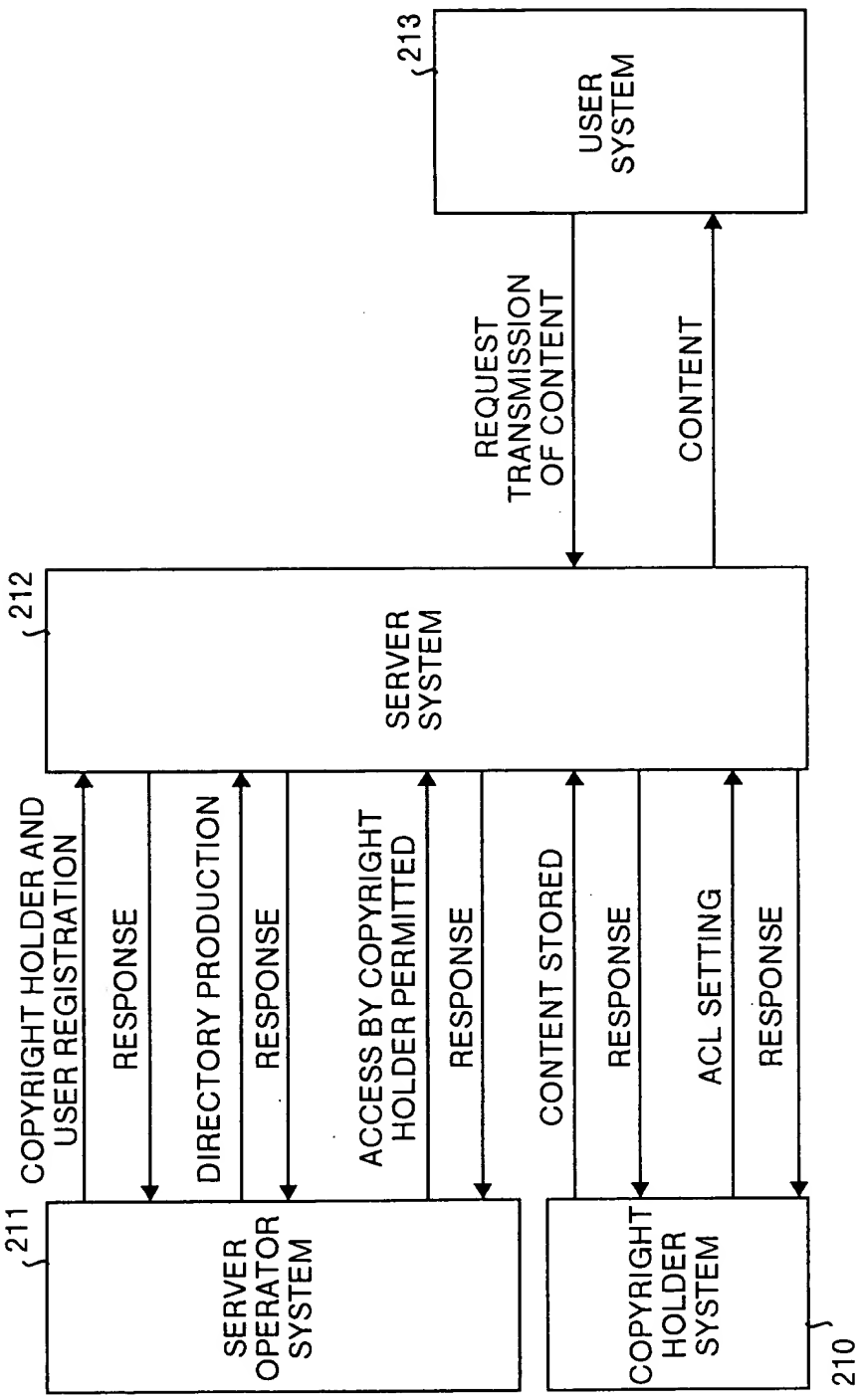

213
USER SYSTEM
REQUEST TRANSMISSION OF CONTENT
CONTENT
212
SERVER SYSTEM
COPYRIGHT HOLDER AND USER REGISTRATION
RESPONSE
DIRECTORY PRODUCTION
RESPONSE
ACCESS BY COPYRIGHT HOLDER PERMITTED
RESPONSE
CONTENT STORED
RESPONSE
ACL SETTING
RESPONSE
211
SERVER OPERATOR SYSTEM
COPYRIGHT HOLDER SYSTEM
210

FIG.19

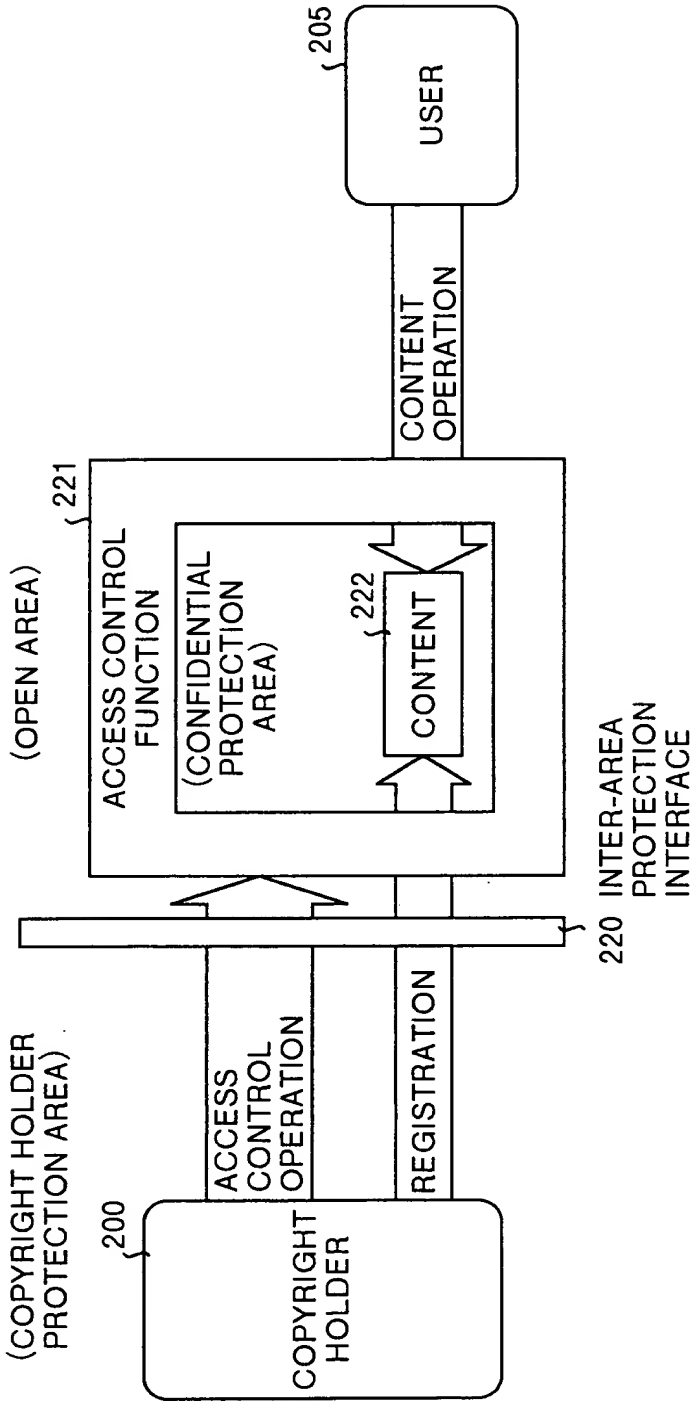

205
USER
CONTENT OPERATION
221
(OPEN AREA)
ACCESS CONTROL FUNCTION
(CONFIDENTIAL PROTECTION AREA)
222
CONTENT
220
INTER-AREA PROTECTION INTERFACE
(COPYRIGHT HOLDER PROTECTION AREA)
200
COPYRIGHT HOLDER
ACCESS CONTROL OPERATION
REGISTRATION

FIG.20

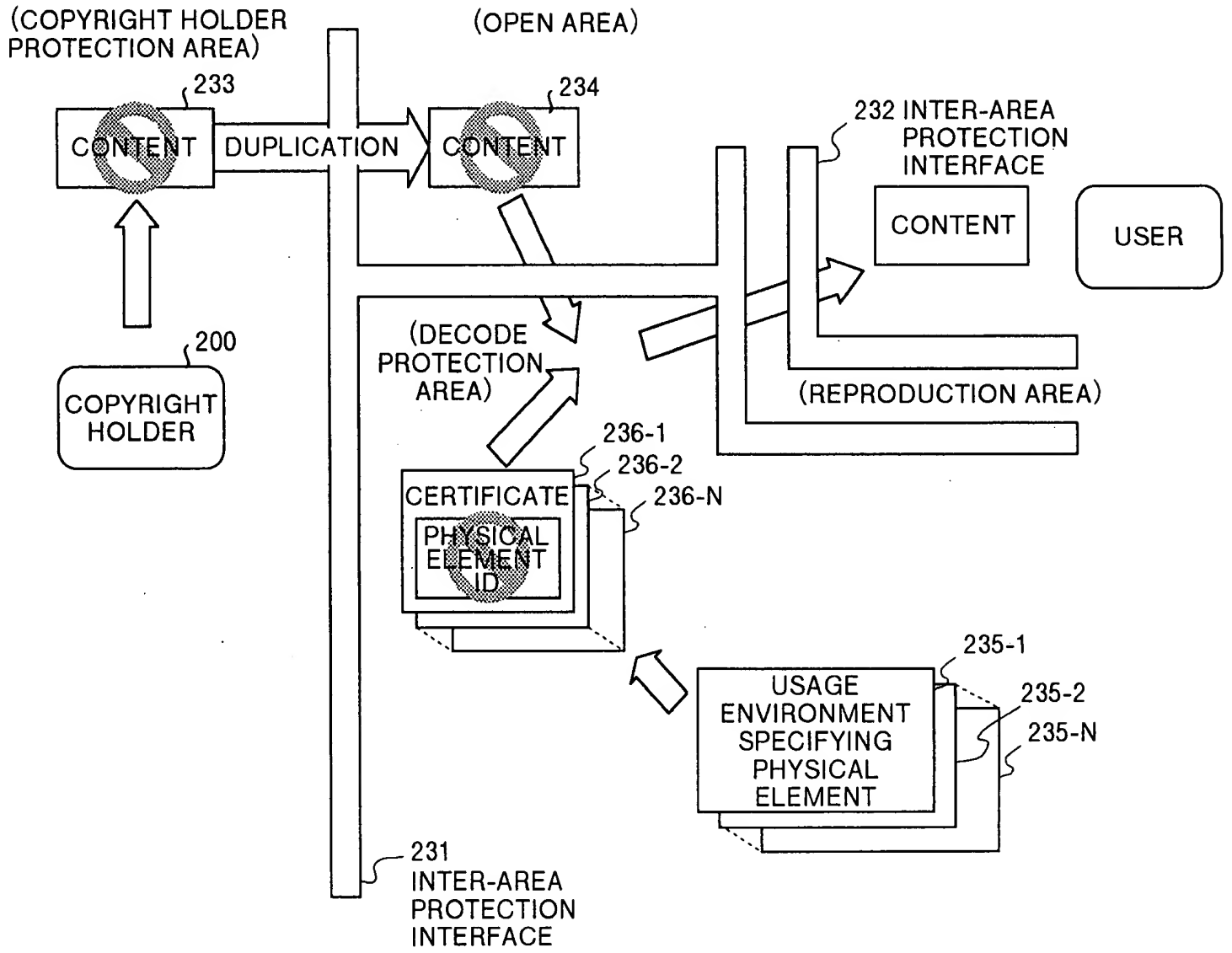

(COPYRIGHT HOLDER PROTECTION AREA)
(OPEN AREA)
233
234
CONTENT
DUPLICATION
CONTENT
232 INTER-AREA PROTECTION INTERFACE
CONTENT
USER
200
COPYRIGHT HOLDER
(DECODE PROTECTION AREA)
(REPRODUCTION AREA)
236-1
236-2
236-N
CERTIFICATE
PHYSICAL ELEMENT ID
235-1
235-2
235-N
USAGE ENVIRONMENT SPECIFYING PHYSICAL ELEMENT
231
INTER-AREA PROTECTION INTERFACE

FIG.21

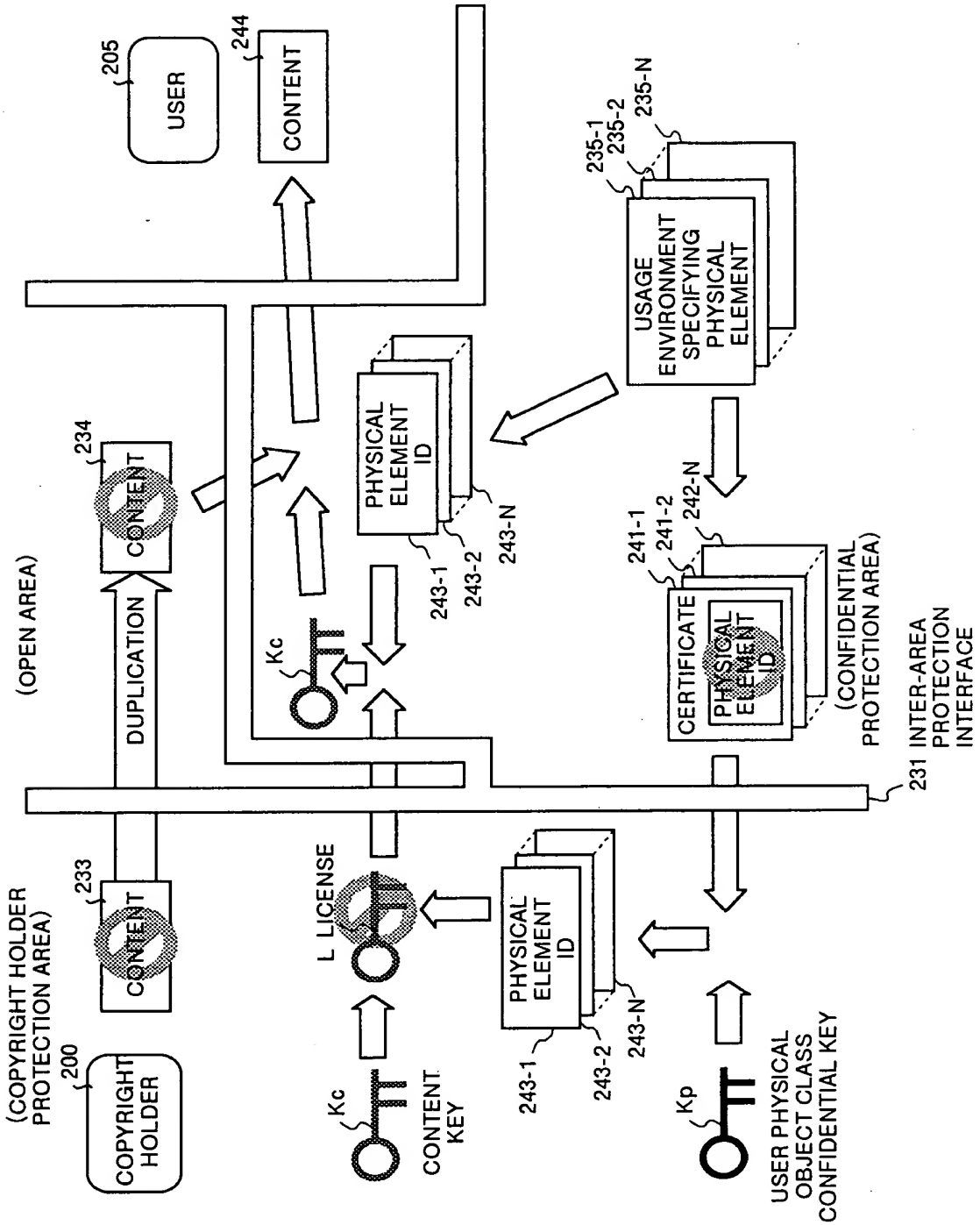

(COPYRIGHT HOLDER PROTECTION AREA)
200
COPYRIGHT HOLDER
233
CONTENT
DUPLICATION
234
CONTENT
(OPEN AREA)
205
USER
244
CONTENT
L LICENSE
Kc
CONTENT KEY
PHYSICAL ELEMENT ID
243-1
243-2
243-N
USAGE ENVIRONMENT SPECIFYING PHYSICAL ELEMENT
235-1
235-2
235-N
241-1
241-2
242-N
CERTIFICATE
PHYSICAL ELEMENT ID
(CONFIDENTIAL PROTECTION AREA)
231 INTER-AREA PROTECTION INTERFACE
Kp
USER PHYSICAL OBJECT CLASS CONFIDENTIAL KEY

FIG.22

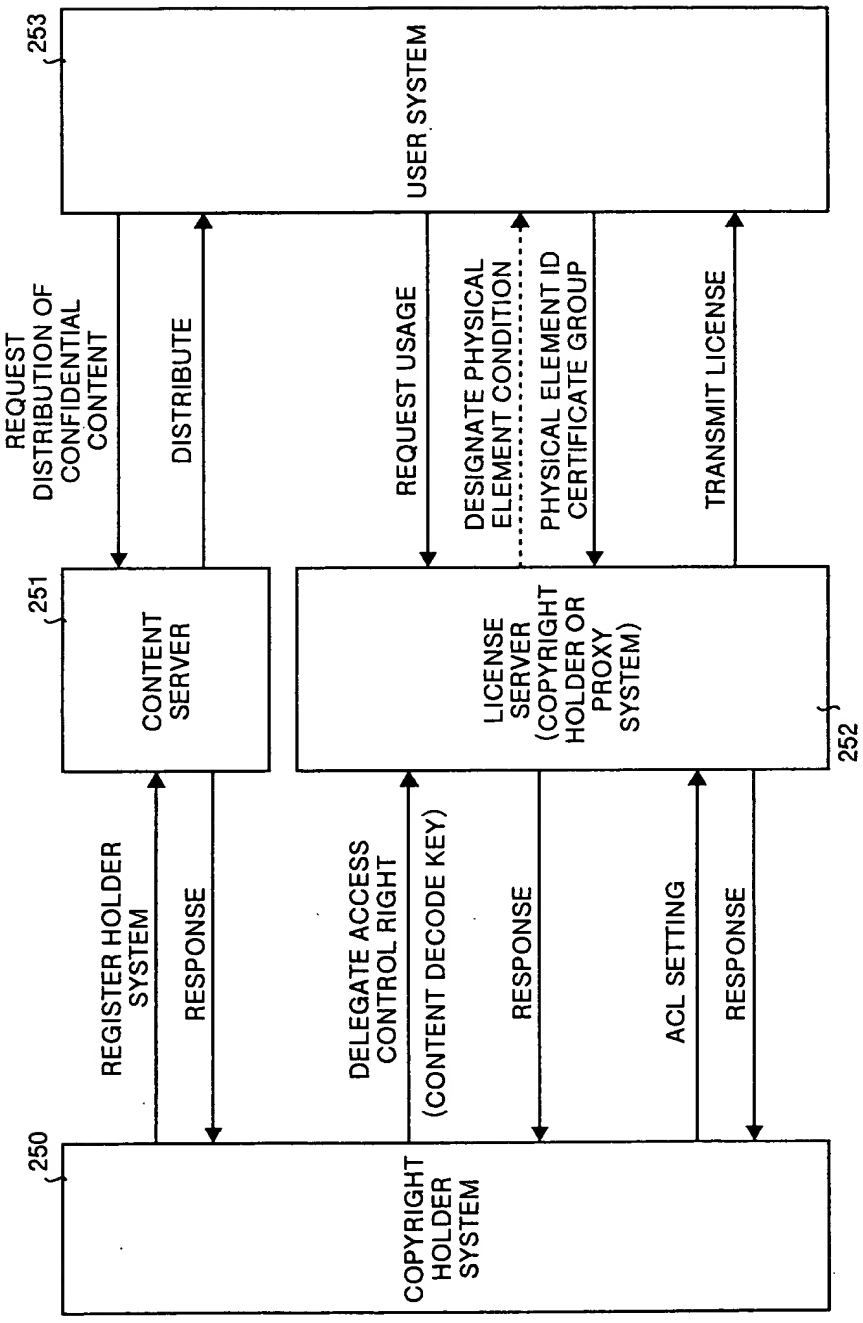
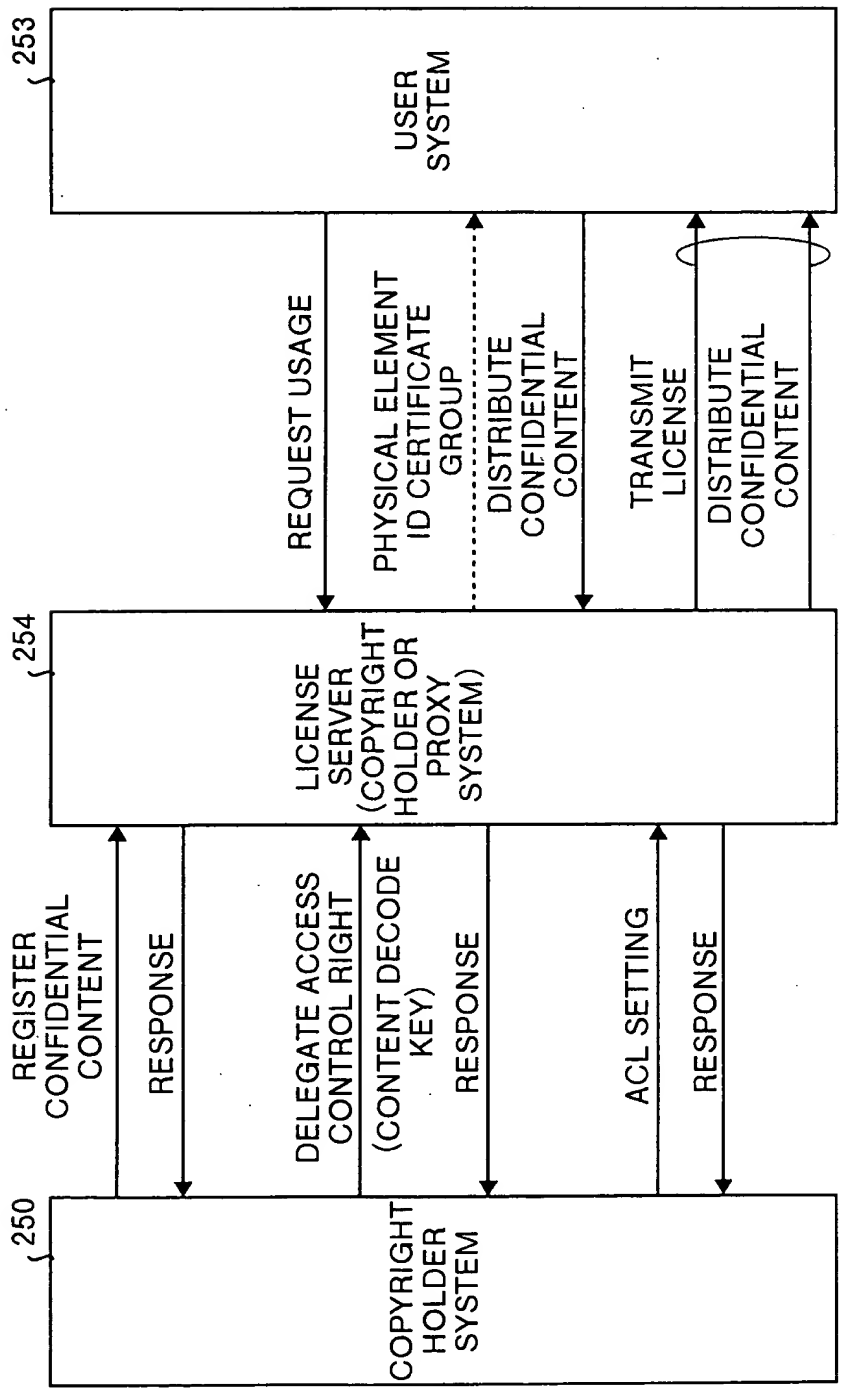

253
USER SYSTEM
REQUEST DISTRIBUTION OF CONFIDENTIAL CONTENT
DISTRIBUTE
REQUEST USAGE
DESIGNATE PHYSICAL ELEMENT CONDITION
PHYSICAL ELEMENT ID CERTIFICATE GROUP
TRANSMIT LICENSE
251
CONTENT SERVER
LICENSE SERVER (COPYRIGHT HOLDER OR PROXY SYSTEM)
252
REGISTER HOLDER SYSTEM
RESPONSE
DELEGATE ACCESS CONTROL RIGHT
(CONTENT DECODE KEY)
RESPONSE
ACL SETTING
RESPONSE
250
COPYRIGHT HOLDER SYSTEM

FIG.23


253
USER SYSTEM
REQUEST USAGE
PHYSICAL ELEMENT ID CERTIFICATE GROUP
DISTRIBUTE CONFIDENTIAL CONTENT
TRANSMIT LICENSE
DISTRIBUTE CONFIDENTIAL CONTENT
254
LICENSE SERVER (COPYRIGHT HOLDER OR PROXY SYSTEM)
REGISTER CONFIDENTIAL CONTENT
RESPONSE
DELEGATE ACCESS CONTROL RIGHT
(CONTENT DECODE KEY)
RESPONSE
ACL SETTING
RESPONSE
250
COPYRIGHT HOLDER SYSTEM